

Space News Roundup

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National Aeronautics and Space Administration

The Station

Significant engineering talent now unleashed, Hutchinson says

The 21-month Space Station Phase B contracts now on the street herald the beginning of a new push in which all of the ideas, plans and designs formulated after more than a year of intensive studies will be taken apart, scrutinized and then put back together again.

"For the next nine or ten months, we will disassemble the design and put it back together like we want it," said Program Manager Neil Hutchinson. "We'll decide what on it is right and what isn't. Then for the last 11 months or so of Phase B, we will be involved in preliminary design — drawing the blueprints."

Hutchinson's comments came April 22 during his first news conference since assuming the program manager position. About 300 contractor officials were at JSC that day for the kickoff meeting of the Phase B contract period. "We've turned them loose to go do it," Hutchinson said.

Although a great many engineering specifics are still under

study, a general picture of the Station's features and capabilities has been formulated as part of the reference configuration — the Power Tower — which forms the starting point for the Phase B studies.

The Station will be placed in a low Earth orbit between 250 and 300 nautical miles, flying in a gravity gradient stabilized orientation. It's power generation system — whether based on solar array technology or solar thermal dynamics (where the sun's heat is collected by a mirror, focused on an evaporator and used to power a turbine) — will supply 75 kilowatts to the Station. The basic structure of the Station, it's keel essentially, will be a nine-foot-square truss which can be deployed, assembled or both.

"The primary cruciform of the Station will fit in two Shuttle payload bays," Hutchinson said. "Obviously, its packing density will be very high."

(Continued on page 2)

MacDac, Rockwell teams chosen for JSC work package contracts

McDonnell Douglas Astronautics Co. and Rockwell International have been selected for fixed-price contracts to perform 21-months of work on JSC's portion of the Phase B Space Station effort.

The contracts went to McDonnell Douglas' Astronautics Co., a California based division of McDonnell Douglas Corp. in Huntington Beach, and to Rockwell's Space Station Systems Division, also based in California, at Downey.

JSC's element of phase B, Work Package Two, covers definition and preliminary design of the structural framework of the Space Station, as well as the interface between the Station and visiting Shuttles, and such mechanisms as the remote manipulator system, attitude control, thermal control,

communications and data management systems and crew accommodations.

Phases C and D of the Station program will be combined. Those phases will encompass final design and development, manufacture of the components, hardware integration, launch and, finally, assembly in orbit.

The team led by McDonnell Douglas consists of IBM, Honeywell, RCA, Ball Aerospace, Computer Sciences, Design West, Communications and Data Systems Associates, Eagle Engineering, Essex, Fluor, Ford Aerospace, Hamilton Standard, ILC Space Systems, SPAR Aerospace and LTV Aerospace.

The team led by Rockwell consists of Grumman, Harris, Sperry, Intermetrics and SRI International.

Agreements with Europe, Canada and Japan expected this month

Agreements are in hand or will be signed within the next two weeks bringing the European Space Agency, Japan and Canada into the Space Station Program as partners in the Phase B effort.

Administrator James M. Beggs and Canadian Minister of Science and Technology Tom Siddon signed a memorandum of understanding April 16. NASA will sign an agreement with ESA in late April and with Japan on May 9 in Tokyo.

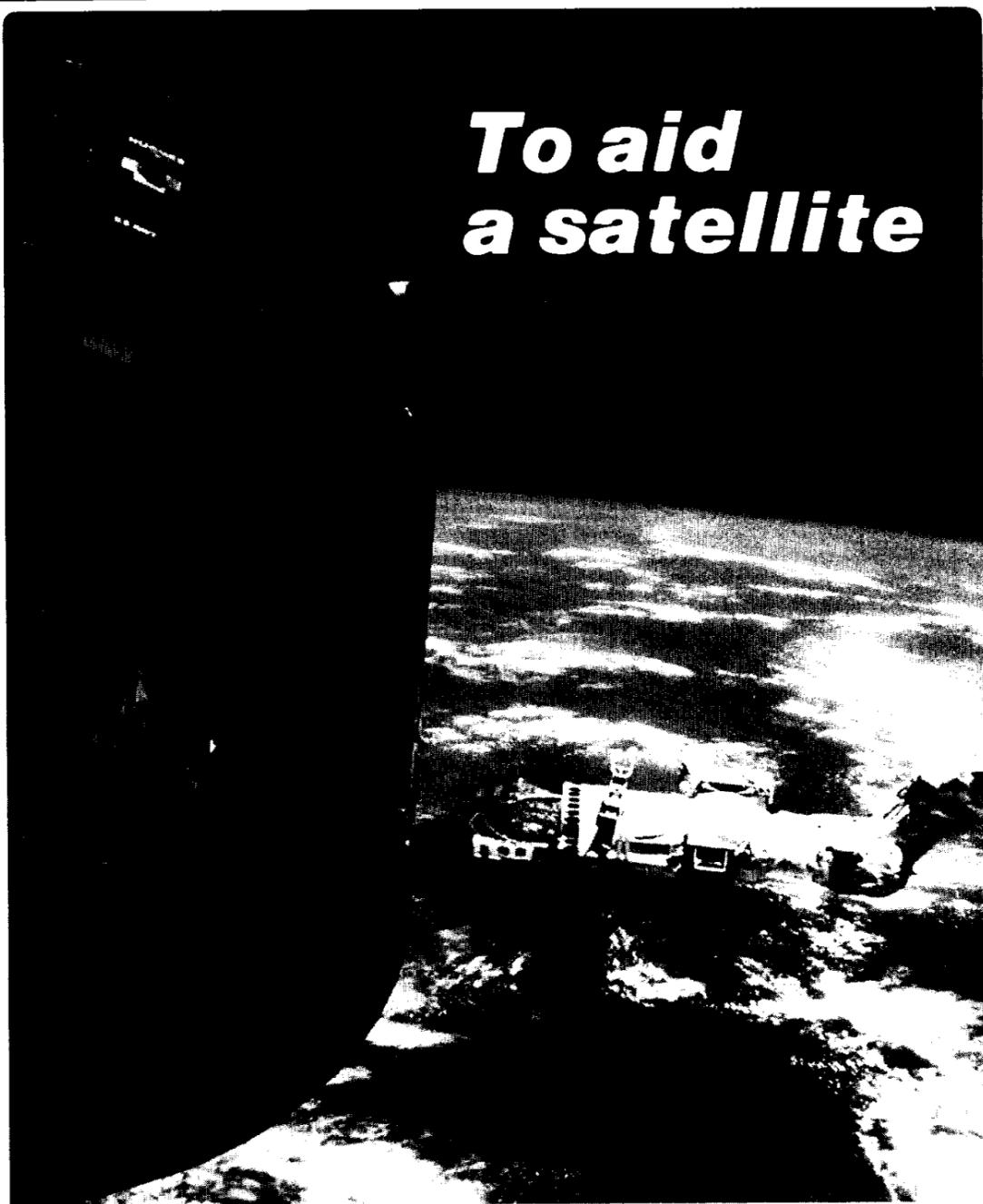
Under the memorandum of understanding, Canada and the United States will conduct and coordinate parallel Phase B studies. The agreement provides for interaction and information exchange during the next two years.

Canada, which has approved \$8.8 million for the first year of

Phase B, will study a space construction and servicing system; a solar array for a platform or as a potential auxiliary power source for the Space Station; and a remote sensing facility.

"We are pleased that Canada has become an international partner in the definition and preliminary design phase of the Space Station's development," Beggs said. "We look forward to working with our friends in Canada, Europe and Japan in building a firm foundation for future cooperation on a permanently manned Space Station to serve the needs of the Free World in developing the peaceful uses of space well into the next century."

Additional cooperation during later stages of the Space Station program will require separate agreements, NASA Headquarters said.



To aid a satellite

Despite a hard pressed repair attempt, fixing Syncom IV-3 was not in the cards

There were times during STS 51-D, Commander Bo Bobko said, when trips to *Discovery's* teleprinter reminded him of TV's Mr. Phelps, the silver haired man who had weekly sessions with a tape recorder as leader of the Impossible Missions Force.

This particular mission hadn't been planned that way, of course. It was to have been a routine deployment flight, dropping off a Telesat satellite for Telesat Canada and a Syncom IV (Synchro-nous Communications) satellite for Hughes Communications. When Syncom IV-3 slid out of the *Discovery's* payload bay April 13, however, the pre-mission plans went out with it. For reasons still not clearly understood, Syncom failed to activate according to a prescribed sequence of events: a post ejection sequencer was to have activated at 30 seconds; an omnidirectional antenna was to have deployed at about one minute, spin-up was to have begun at seven minutes, increasing Syncom's rotation from 2 to 33 rpm; and the perigee kick motor was to have fired at deploy plus 45 minutes.

The crew observed this lack of activity as the Syncom moved away at 1.5 feet per second. "Houston, we are watching the Syncom, and the omni antenna is still down," radioed Mission Specialist Rhea Seddon. After 15 minutes, *Discovery* executed a posigrade separation, rose above

Syncom and, in a higher orbit, fell behind the satellite to a safe distance just in case the PKM fired. It didn't, and as Syncom continued its majestic slow roll through space, engineers on the ground tried to understand the failure mechanism, why, in the words of a payloads engineer, "there just weren't any ones and zeros coming from the spacecraft."

From that point on, NASA and Hughes went into a troubleshooting mode: Hughes to try and diagnose Syncom's problem, NASA to study methods by which the crew might attempt any fixes. The initial thinking from Hughes was that the arming lever, the umbilicals or the onboard batteries were the most likely sources of the problem, although the lever was the only single point failure that could be identified. The lever was designed to be activated as Syncom rolled out of its cradle. In that process, it was intended to force two switches to turn the satellite's power on. The arming lever scenario gave the NASA team something to work with, because an attempt to activate the micro-switches by moving the lever was the one thing the *Discovery* crew could try with any chance of success.

Equipment duplicating the arming lever and related mechanisms was flown in from the Hughes plant in California that afternoon,

while at JSC, work began almost immediately to build a scale replica of the satellite.

By late Saturday afternoon, a series of meetings had begun. The meetings would continue for the next four days. There were three gatherings, initially: one to examine the safety issues involved, one to study rendezvous possibilities, and a third to figure out what to do if *Discovery* did rendezvous. By the next morning, planning began to point to a photographic survey effort at the least, possibly even a contingency EVA.

By mid-morning Sunday, JSC was a hotbed of activity. Robert Crippen and Rick Hauck flew rendezvous runs in the Shuttle Mission Simulator; Jerry Ross and Woody Spring practiced EVA possibilities in the Weightless Environment Training Facility; Pinky Nelson and Bruce McCandless, fully suited in 1G, practiced pulling at the lever as a mock Syncom was twirled at 2 rpm from a rolling crane in Bldg. 9A. During the day, no less than six flight directors, three crew commanders from past missions, two directors of, one director for, a multitude of senior flight controllers and a wide assortment of flown astronauts passed in and out of the MOCR and the rooms in Bldg. 30 where ideas were discussed and evaluated, and then discarded or built upon.

(Continued on page 3)

Bulletin Board

Lovelace to address AIAA

Former NASA Deputy Administrator Dr. Alan M. Lovelace will discuss "The New Threshold for Aerospace" at the next dinner meeting of the Houston Section of the American Institute of Aeronautics and Astronautics May 10. Lovelace, now the Vice-President and General Manager of the Space Systems Division, General Dynamics Corp., is the AIAA President-Elect for 1985-86. The dinner meeting will be held at the Gilruth Recreation Center with a social hour beginning at 5:30 p.m., dinner at 6:30 p.m. and the program at 7:30 p.m. The price is \$9 for members and spouses and \$10 for non-members with a \$2 discount to students and young members. For reservations, call La Rue, 333-4150, x267; Joanne, 333-0596; Carol, 488-5660; or Christine, 333-6492.

Women's week observance is May 14-16

The Eighth Annual Women's Week observance at JSC, May 14-16, will feature a luncheon, a fashion show and presentations on several topics. The program will begin at 11:30 a.m. May 14 with a luncheon at the Gilruth Recreation Center. Elizabeth Spates, a member of the board of the Houston Independent School District, will deliver the keynote address at 12:30 p.m. A fashion show sponsored by Foley's will follow at 2 p.m. The May 15 program will feature seven presentations: "Office Automation" and "Making Personal and Professional Change Work for You" at 8:30 a.m.; "Spaceships Don't have Rearview Mirrors," "Communications," and "What's There to Fear? Change is a Part of Life," all at 10:30 a.m.; and "Drugs and Alcohol" and "Sexual Harassment" at 1:30 p.m. The May 16 session also will feature seven presentations: "Using Your Networks to Expand Your Horizons," "Women's Property Rights Under the Texas Law," and "Stress Management" at 8 a.m.; "Citizens Against Crimes," "Office Automation," and "Women and Suicide" at 10:15 a.m.; and "Networking Professionalism" with Claudette Sims at 1 p.m. Reservations are required only for the opening session. For more information, call Shirley Price, x4831.

Seabrook regatta is May 11

The Seabrook Sailing Club will hold its second annual "Quick and Dirty" Regatta on Saturday, May 11 with registration beginning at 9 a.m. The regatta is designed around several short races intended to encourage beginners and old timers to come out and try their strategy and tactics. All races will be sailed in accordance with current USYRU rules and class rules where applicable. The 720 rule will be used, and Coast Guard safety equipment is required. All classes are invited and will be raced Portsmouth Handicap. A registration fee of \$7 will be due at the Sailing Club Saturday morning. Five trophies will be awarded and lunch and dinner are available. For more information, call Regatta Chairman Carl Hacker at 977-9754.

NMA Council plans clinic

The National Management Association, Gulf Coast Council, is sponsoring a chapter operations clinic from 8:45 to 2:10 p.m. May 11 at the League City Civic Center, 300 West Walker. Otis Baskin, Director of the Center for Advanced Management Programs at the University of Houston-Clear Lake, will be the principal speaker. Workshops will be held to assist new officers and chapter operations personnel in the performance of their duties. The Gulf Coast Council is made up of nine area NMA chapters, including those from CSC, Rockwell, Singer and Lockheed. For more information, call Don Hawkins, 333-6537 or Art Authier, 333-6307.

Osborne group to meet

The Clear Lake Osborne and CP/M computer group will hold its next meeting at 9 a.m. May 11 at the Gilruth Recreation Center. The group is open to students and all CP/M computer enthusiasts. Interested persons need not own a computer to attend the meeting. The group offers discounts, assistance, education and information exchange. Some of the CP/M machine owners in the group represent Osborne, Morrow, KayPro, Zorba and LoboMax. For more information, call William Gill, 326-2870 or write to CLOG, P.O. Box 57613, Webster, 77598.

Vintage radio show is May 4

The Houston Vintage Radio Association will hold its sixth annual show and auction on Saturday, May 4, from 10 am to 5 p.m. at the Memorial City Shopping Center, I-10 at Gessner. Many old radios from the wireless era to World War II will be on display. The show and auction is open to the public. The auction will be held from 1:30 to 5 p.m. For more information, call Dave Moore, x2886 or 485-1705.

Cookin' in the Cafeteria

Week of May 6 — 10, 1985

Monday — Chicken Noodle Soup; Wieners & Beans, Round Steak w/Hash Browns, Meatballs & Spaghetti (Special); Okra & Tomatoes, Carrots, Whipped Potatoes. Standard Daily Items: Roast Beef, Baked Ham, Fried Chicken, Fried Fish, Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday — Beef and Barley Soup; Beef Stew, Shrimp Creole, Fried Chicken (Special); Stewed Tomatoes, Mixed Vegetables, Broccoli.

Wednesday — Seafood Gumbo; Fried Perch, New England Dinner, Swiss Steak (Special); Italian Green Beans, Cabbage, Carrots.

Thursday — Cream of Chicken Soup; Turkey & Dressing, Enchiladas w/Chili, Wieners & Macaroni, Stuffed Bell Pepper (Special); Zucchini Squash, English Peas, Rice.

Friday — Seafood Gumbo; Baked Flounder, 1/4 Broiled Chicken w/Peach Half, Salisbury Steak (Special); Cauliflower au Gratin, Mixed Vegetables, Buttered Cabbage, Whipped Potatoes.

Week of May 13 — 17, 1985

Monday — Chicken & Rice Soup; Wieners & Sauerkraut, BBQ Ham Steak, Steak Parmesan, Beef & Macaroni (Special); Green Beans, Carrots, Au Gratin Potatoes. Standard Daily Items: Roast Beef, Baked Ham, Fried Chicken, Fried Fish, Chopped Sirloin. Selection of Salads, Sandwiches and Pies.

Tuesday — Tomato Soup; Potato Baked Chicken, BBQ Spare Ribs, Mexican Dinner (Special); Squash, Broccoli, Ranch Beans, Spanish Rice.

Wednesday — Seafood Gumbo; Liver & Onions, Baked Turbot, BBQ Ham Steak, Baked Meatloaf w/Creole Sauce (Special); Beets, Brussels Sprouts, Green Beans, Whipped Potatoes.

Thursday — Beef & Barley Soup; Chicken & Dumplings, Corned Beef w/Cabbage, Smothered Steak w/Cornbread Dressing (Special); Spinach, Cabbage, Cauliflower au Gratin, Parsley Potatoes.

Friday — Seafood Gumbo; Pork Chop w/Yam Rosette, Creole Baked Cod, Tuna & Salmon Croquette (Special); Brussels Sprouts, Green Beans, Buttered Corn, Whipped Potatoes.

New Bldg. 12 facilities offer computer training, demonstration capabilities

With the snip of a ribbon by JSC Associate Director Dr. Carolyn Huntoon, a new facility centralizing computer education and training was opened in April.

The Computer Education Center and the Product Demonstration Facility, both in Bldg. 12, have been set up by the Data Processing Systems Division. The CEC centralizes on-site education programs, while the PDF is the center's first facility geared toward demonstrating office computer equipment to employees.

Over the past 14 months, DPSD has provided computer education for 2,910 students, with enrollment averaging 300 students each month. Those figures equate to over 22,000 classroom hours, said DPSD Education Coordinator Micki Wiesner.

Division Chief John Garman said DPSD's goal is to build a communications backbone for the Center — a computer network — and to increase institutional computing power. He noted that DPSD now provides such aids as a Service Center Help Desk, product demonstration and prototyping, requirements assessment and analysis, user work station support and applications development.

PDF Supervisor Bill Vasen said the new facility is a showroom of office automation equipment and software which is open to all JSC and contractor employees. The facility gives people a chance to operate work stations and try software or peripherals such as printers.

The PDF is located in Room 112 of Bldg. 12 and is open from 8:30 a.m. to 4:30 p.m. Products include a variety of hardware and software systems available for "test drives." Demonstration of DPSD-supported products are provided, along with consultation and assistance. The PDF also has manuals, brochures and reference material on hand.

The Education Center, also in Bldg. 12, provides the same type of services as are available off-site in the Beta Bldg. Both centers are equipped with Sony large-screen projection systems capable of displaying images from such sources as computer terminals, video recorders and closed circuit TV. Courses are offered for several types of computer hardware, as well as software packages such as Lotus 1-2-3, the PFS Series, dBase, NOMAD2 and others. The computer education program continues to be expanded as new DPSD-supported products are added to meet the needs of the user community.

The Help Desk, located at Computer Sciences Corp. offsite, was developed to provide users with a single point of contact for inquiries, problems and consultation. If immediate solution to problems cannot be provided, the Help Desk



Employees try out varied computer equipment in the Product Demonstration Facility.



Visitors tour the newly opened PDF during dedication ceremonies.

will research the situation and provide either a solution or a plan of attack within two hours.

Development of the demonstration facility and education center in Bldg. 12 began during the summer of 1984. DPSD was assisted in the effort by JSC's Facilities Design, Telecommunications, Television, Supply Operations, Procurement and Employee Development groups. While the

effort was underway, training was conducted in Bldgs. 32A and 45, as well as at CSC.

For more information on the Product Demonstration Facility or computer education at JSC, call x2564 between 8:30 a.m. and 4:40 p.m. Assistance in using products and any additional information about the CEC can be obtained by calling the Help Desk at 280-4800. — Gayle Taylor

Work intensifies with Phase B

(Continued from page 1)

Cabling and utilities will be strung throughout the trusswork, but whether the cabling will be done by EVA shuttle crew members or installed on Earth is still under study, he said.

Station designers have also considered a small nuclear power plant as a source of energy for the facility. "We're fairly certain nuclear power will not be used in the IOC (initial operating capability) Station, but we don't want to make design decisions that would prohibit its use in the future," Hutchinson said.

One example of the kinds of engineering discussions which will take place over the next several months is in the area of maintaining

the Station's orbital altitude. Because of its large size and drag, it will be necessary to periodically reboost the Station to its nominal operational altitude. But reboosting can present problems to customers, whose equipment operations aboard the platform could be disrupted by any changes in the micro gravity environment, even though the delta vee needed for reboost would be small.

Accordingly, designers are looking at several ways of reboosting the Station, ranging from one series of thrusts periodically, or small incremental thrusts done more often. Another scenario involves using the waste gases out of the Station's environmental control system to

supply reboost. A fourth idea, perhaps too exotic for the IOC Station, Hutchinson said, would be to use the momentum exchange generated by tethered payloads to boost the Station when necessary.

"We have unleashed a significant amount of engineering talent to study these kinds of things, within both the JSC and contractor communities," Hutchinson said. He estimated that from 800 to 900 federal employees will be working on the Station project by midway through Phase B, and that several hundred people at both Rockwell and McDonnell Douglas, the two contractors for the JSC work package, will be devoted to Station efforts.

How to build the better flyswatter

1. Take one Space Shuttle vacuum cleaner, one circuit breaker tool, several Flight Data File covers, wire, two kinds of tape, one bone saw and a Swiss Army knife. Await instructions.



Orbit 1 Team Flight Director John Cox explains the flyswatter to the news media at his daily press conference. . .

(Continued from page 1)

By 6 p.m. Sunday, a decision was announced which narrowed the possibilities. The Mission Management Team decided not to exercise any option which would involve placing an EVA astronaut in any close proximity to Syncom. In other words, no astronauts at the end of *Discovery's* robot arm, being maneuvered between a 210,000 pound orbiter and a 14,000 pound slowly spinning satellite. This did not, however, rule out an EVA entirely, nor at the time, did it rule out an astronaut effecting the repair.

The teams studying the problem began concentrating their thinking toward fashioning a tool which could be used to snag the activation lever. To that end, a call went out over the Flight Director loop for the EECOM (Electrical, Environmental, Consumables and Mechanical Systems) team in particular, and other controllers in general, to look through their lists of materials packed aboard *Discovery* for something long, such as aluminum tubing, which could be fashioned into a snare 12 or 15 feet long. Perhaps a crewman could wield the snare, or it could be attached to the robot arm. One initial idea was to take aluminum tubing from the Telesat sunshield assembly. Later, the EECOM assessment showed an easier source of raw material: the handhold rails along the front of the Continuous Flow Electrophoresis System and tubing from the treadmill aboard for crew exercise. Total tubing length: about 12 feet.

Planning continued to coalesce through Sunday night and Monday morning, and it was during this period that the "flyswatter" concept was born. The leading plan was to fashion a tool from materials in the cabin, attach the tool to the RMS during an EVA, then close on Syncom the following day. From an engineering design standpoint alone, this was no small

task. The raw data used to come up with a design went something like this: Syncom's activation lever would move with from 5 to 10 pounds of force applied; something must snag the lever, and that something must be attached to the RMS; the satellite weighs two tons, and all of that mass is spinning at 2 rpm; the tool must snag the lever with enough force to move it, but must be weak enough to give way, so as not to damage the RMS. That said, it then remained for the ground team to come up with materials on hand, in a spacecraft orbiting 200 miles above the planet, which could be assembled into a useable tool through instructions relayed either by voice, teleprinter or both. The Great Flyswatter Design Effort was on.

In the meantime, another team had to design a rendezvous plan for Commander Bobko and Pilot Don Williams. Their last rendezvous training was almost a year in the past. Although *Discovery* was fat on fuel, a complex rendezvous, unplanned and not trained for, also was no small undertaking. Flight director Jay Greene, who worked the STS 51-A rendezvous, went off with a team to plan a rendezvous. Another mission operations team, led by flight director Larry Bourgeois, had by this time come up with a candidate flyswatter design. That group consisted of members of the in-flight maintenance team, "the IFM folks," who operate out of the EECOM section. For their efforts, Robbie Robbins, Jerry Johnson, Frank Janes and Tom Pierson were honored at the conclusion of the flight by being selected to hang the 51-D patch in the MOCR.

The flyswatter's basic components consisted of a "swizzle stick," an aluminum rod used to throw hard to reach circuit breakers during launch and entry, the triangular-shaped suction tip from the Orbiter's vacuum cleaner, pieces of plastic from Flight Data

File covers, wire and lots of tape. By Monday, a second flyswatter design had been contributed by a team in the Research and Engineering side of the house. That design called for extracting stays from an interdeck sunshade, clipping one end to form a U-shaped brace, then notching the open end and attaching a slotted piece of plastic to it.

Tests then had to be performed on the homemade tools to determine how they would hold up in vacuum and the extreme temperatures of space. The plastic material was dipped in liquid nitrogen; the flyswatters themselves were put in the vacuum chamber and subjected to temperature extremes. As those tests were underway, a third design called the lacrosse stick was developed as a backup to the first two. This used the same shade stay for its basic structure, but the business end was a loop of teflon coated wire, instead of plastic.

Even as all of this was going on, before the final designs had been passed through the thermal-vac tests, instructions for flyswatter construction were teleprinted up to the crew. The Flight Activity Officers and their teams were put to the test as they constructed messages which would make sense of the intricate fabrication techniques. Teleprinter messages have the same limitations as typewritten documents. To the FAOs fell such tasks as drawing an arming lever diagram with X's and O's.

As each of these efforts led toward Tuesday's EVA, the crew spent the better part of Monday afternoon building flyswatters and lacrosse sticks. "This has really been an interesting day," Mission Specialist Jeff Hoffman said at one point. "We had toys this morning, and arts and crafts in the afternoon."

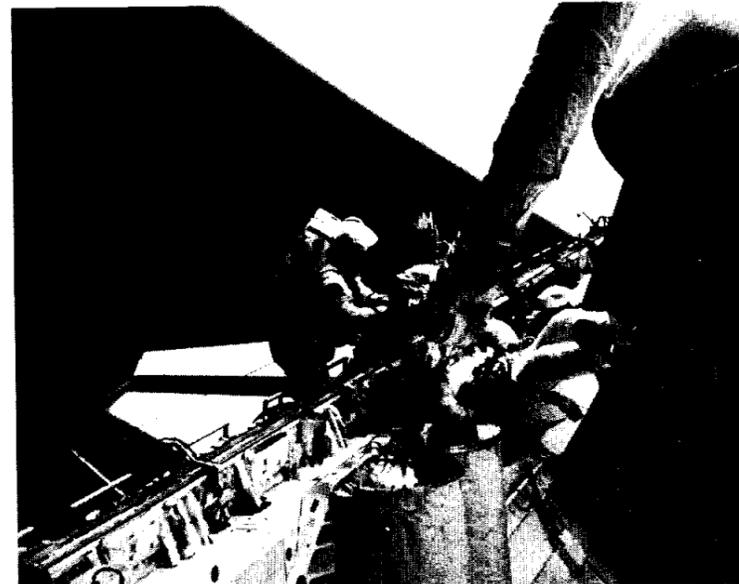
As the EVA approached, attention began to shift from tests on the ground to the real thing in space. "The EVA plan is definitely free form," Lead Flight Director Randy Stone told reporters at his daily news conference. Later, he said, "the only way we had a snowball's chance of pulling any of it off was taking it in a very relaxed manner. We had to do the EVA one step at a time, then go on to the rendezvous."

Thus on April 16, astronauts Hoffman and David Griggs cracked the hatch and stepped out into the payload bay, for the first contingency EVA in Shuttle history, carrying with them three makeshift tools. The spacewalk went well. Now it was up to Bobko and Williams to fly *Discovery* back to Syncom, and up to Seddon to attempt a snag with the robot arm.

Early Wednesday morning, *Discovery* closed the distance with Syncom and came up from behind



...while Rhea Seddon constructs one in orbit. . .



...and Jeff Hoffman and Dave Griggs attach the three versions to the Orbiter's robot arm.

and beneath the satellite. Jay Greene, who acted as flight director for the rendezvous, said Bobko and Williams used almost exactly the same propellant as had been estimated as average usage for the 51-A rendezvous maneuvers.

Finally, on the descending node of Orbit 79, just past the equator over the Atlantic Ocean, it was all up to Rhea Seddon. A six minute window opened, timed so that if the attempt was successful, Syncom's PKM would fire 45 minutes later when the satellite was in the proper geometry for the trip to geosynchronous orbit.

Seddon moved the arm in slowly, and made the first snag attempt about 1 minute 45 seconds into the window. One of the flyswatters almost ripped on a pivot pin just above the lever, and Seddon backed the arm out. At 2 minutes 30 seconds she made contact with

a flyswatter and it ripped away as expected. About 30 seconds later she tried again, catching the lever with the lacrosse stick. Almost four minutes into the window, she hit the lever a third time with the hard cone-shaped base of a flyswatter.

At six minutes into the window, CapCom Dave Hilmers radioed the crew, "*Discovery*, the window is closed. Perform the separation maneuver."

Slowly, the ship moved off, leaving Syncom still spinning, albeit somewhat slower. The satellite had failed to activate, but not for want of an extensive effort, one likened to the efforts to salvage Skylab, and before that, to save the Apollo 13 crew in far more difficult circumstances.

In the end, it was, in Bobko's words, "a demanding, challenging and extremely exciting spaceflight. It was JSC at it's finest."



Bobko and Williams at the Teleprinter. Feeling a bit like Mr. Phelps.

Roundup Swap Shop

All Swap Shop ads must be submitted on a JSC Form 1452. The forms may be obtained from the Forms Office. Deadline for submitting ads is 5 p.m. the first Wednesday after the date of publication. Send ads to Roundup, AP3, or deliver them to the Newsroom, Bldg. 2 Annex, Room 147. No phone in ads will be taken.

Property & Rentals

For sale: Wedgewood, 3-2-2 (Friendswood), 1,700 sq. ft., covered patio, FPL, detached garage, \$59,500. Call Sharon, x4231 or 482-6046 evenings.

For lease: Waterfront condo, 2-2, FPL, pool, pier, completely furnished incl., furniture, linens, dishes, plants, bbq. Call Marion Bell, x4208 or 481-2157.

For lease: League City, 4-2-2, FPL, fenced, cul-de-sac, pool, tennis, three blocks from elementary school, \$575/mo. Call Tim x2276 or 280-5226.

For sale: Friendswood/Wedgewood, 3-2-2, 2,000 sq. ft. +, new carpet, paint, 30' x 16' rec room, assumable VA 7.75% loan, \$70,500. Call 482-5393.

For sale: Dickinson, 2-1, 1983 mobile home, 14' x 64' in adult section of park with pool, extras, energy efficient, \$750 and assume \$297/mo. Call Garner, x5827 or 534-3499 evenings.

For sale: Fairmont Park, 3-2-2, formal dining, FPL, fenced back yard, cathedral ceiling, two ceiling fans, C/A 8% VA assumable. Call Hendrickson, x4053 or 470-2293.

For sale/lease: Egret Bay, 1 BR condo, all appliances, waterview, extra nice, no equity. Call 946-2443 or 480-0447 after 5 p.m.

For sale/lease: Lifetime vacation condo on Lake Conroe with exchange privileges to international condos. Call Don, 280-6307 or 554-6205.

For rent: Deer Park, 3-2-2, den, fenced yard, near schools, shopping center, available April 15, lease option, \$500/mo. Call 479-5089 after 5 p.m.

For sale: Brookforest, 4-2-2, unique open home, cathedral ceilings, atrium, spacious, MBR w/garden bath, energy saving, 2,200 sq. ft., financing incl., \$125,000. Call 480-5394.

For sale: University Green, 2-2-2 patio home, split BR design, detached garage, cathedral ceiling, FPL, microwave, close to pool, two yrs. old, \$77,900. Call 488-0500 or 480-6516 after 5 p.m.

For sale: North East Park, 1982 mobil home, 2-2, 14' x 64', W/D connect, excellent cond., no down payment, assume \$286/mo. Call 480-7278.

For rent: Galveston condo, treat yourself to a two day to one month vacation, completely furnished, low rates. Call Nussman, 488-7762.

For sale or lease: Next to NASA, 2 BR condo, kitchen appliances, cable TV, W/D connect, fenced patio, storage room, pool clubhouse, references, \$385/mo. plus deposit. Call Cecil Gibson, x3918 or 488-0719.

For sale or lease: Pasadena, 4-3 townhouse, lease \$600/mo., sell \$54,000; also for sale/lease, ten acres, close in, fenced. Call Damewood, 482-5572.

For sale: Breckenridge, CO, one half acre, ski area, Blue River estates, wooded, level, water, \$36,000. Call Beck, x2071.

For lease: University Green, 2-2.5 condo, purchase option. Call Reid, x5195 or 488-8500.

For rent: Galveston/Tiki island, 3 BR home on canal, dock your boat, fish, swim, TV, master bath spa, week-end, weekly, monthly rates. Call 486-9335.

For sale: Friendswood/Regency Estates, 4-2-2, 90' x 130' lot, inside utility room, open floor plan, lots of windows, gas utilities, high efficiency, AC, \$98,000. Call Steve, x3421 or 482-3696.

For rent: Clear Lake City, 3-2-2, available May 6 with May rent free, \$500/mo., plus deposit. Call 326-6782.

For sale or lease: Egret Bay condo, 2-2-2, W/D, microwave, refrigerator, fans, FPL, pools, boat ramp, 24 hr. security, negotiable. Call Lee, x3431 or 333-9447 after 5 p.m.

For sale: Forest Bend, 4 or 3-2.5-2, pool, six ceiling fans, formals, game-room, bar, lots of trees, no flooding, \$72,500 or assume \$2,500. Call 482-4145.

For sale: Middlebrook II, 4-2-2A, contemporary, open floor plan, vaulted ceiling in living room, master bath has his/her laboratories and closets, FPL, fenced, \$92,900. Call 488-7387.

For sale: Livingston waterfront lot, Barretts Landing, ten miles out of Trinity, good fishing, negotiable. Call M. Clayton, x6571 or 538-3355 after 5 p.m.

For rent: Deer Park, 3-2-2, fenced, FPL, den w/fan, carpeted, split BR design, lease option, \$595/mo. Call 326-4481 or 472-3244.

For lease: Landing condo, 1 BR w/study, quiet, good water view, partially furnished if desired, \$450/mo. Call Corcoran, x4039 or 554-7160.

For lease: Piper's Meadow, 3-2-2, FPL, dining, vaulted ceiling, open floor

plan, perfect for entertaining, excellent condition, available now, \$575/mo. Call 488-0500 or 480-6516 after 5 p.m.

For sale: Waterfront lot on 244 acre lake with access to fishing, tennis, swimming, horseback riding. Call Don, 280-6307 or 554-6205.

For rent: Baywind II, 2-2-2 townhouse, W/D, FPL, very clean, \$450/mo. Call Chuck, x5101 or 480-8452.

For sale: Pasadena off Southmore, 3-1-2, all brick, western room, good investment/starter home, \$49,000, 8.5 FHA. Call Dave, x2557 or 480-4208.

For lease: Baywind II condo, 2-2, W/D connect, FPL, walk-in closets, two free mos. with one year lease, \$400/mo. \$200 deposit. Call 480-9306.

For lease: Baywind II, 1 BR, FPL, W/D connect., one block from NASA, \$325/mo. 12th month of lease free. Call Mason, x5457 or 333-4144.

For sale or lease: Nassau Bay, 4-2-2, 2,200 sq. ft., new carpet, paint, roof, sun deck, 20' FPL, atrium, purchased for \$127,500 sell at \$114,900. Call Jerry, x3561.

For lease: 2-2-1 townhouse, large, fenced, near rec center, library, buses, new air conditioner, paint, \$495/mo. Call 332-3612.

For sale: Heavily wooded two acre homesite corner lot in Splendor, 40 miles N.E. of Houston on I-59, \$16,500. Call 332-0047.

For rent: Seabrook, 4-2, fully or partially furnished, housekeeping and lawn service included, summer 1985-1986, \$850/mo. Call 474-5650 or 474-3319.

For sale or lease: El Dorado Trace, 1 BR condo, immaculate, new carpet, ceiling fans, W/D, pool, rec room, reduced from 34K to 28K, \$315/mo. Call Glenn Smith, x6541 or 486-0462.

For sale or lease: Forest Bend, 2 BR townhouse, quiet, spacious, apply 100% of rent to purchase, bargain price, \$385/mo. Call Glenn, x6541 or 486-0462.

Cars & Trucks

1976 Dodge van B200, 318 V8, ¾ ton, air, PB/PS, AM/FM stereo, sun roof, two beds, two cabinets, used for camping, \$1,500. Call Carl, 280-7094 days or 332-1487 evenings.

1979 Camaro Berlinetta, V8, auto, air, loan value \$3,125, sell for \$2,900, runs well. Call Linda Tiedt, x4921 or 326-2294 after 5:30 p.m.

1977 customized Dodge Maxi-van, AC/PB/PS, auto, AM/FM stereo, CB radio, more, excellent condition. Call Bob, x3445 or 921-1715 after 6 p.m.

1972 VW bug, 500 miles on rebuilt engine, new paint, runs great, \$1,600; also extra set of VW fenders and bumpers, \$100. Call Pat, 280-3519 or 482-8233 after 5 p.m.

1982 Chevy van, Travel Quest conversion, loaded, gray/gray interior, auto/cruise, 40K miles, reduced to \$12,000. Call 280-8221 after 5 p.m.

1977 Malibu Classic, V8, AC/PS, AM/FM/8-track, CB, 70K miles, good condition, \$1,700. Call Betty, x2811.

1977 Ford LTD Landau, two dr., PS/PB/AC/silver, split bench seats, great shape, \$1,750. Call Barbara, x2328 or 482-1106.

1981 Chevette, two dr., four spd., AC, new exhaust, license, insp., tires, clean, \$2,300. Call James Akkerman, x5101 or 488-1493.

1979 Ford van, Midas conversion package, 302 V8, 20K miles on new engine, clean, excellent mechanical condition, \$4,995. Call 488-2754.

1978 Pontiac Sunbird, V6, 65K miles, AC (needs help), AM/FM stereo, good condition, \$1,500. Call Bill, x6186 or 484-3228.

1982 Escort wagon, auto, AC, PS, rear wiper, 41K miles, excellent condition, \$3,800. Call Joe, 280-7827 or 946-8825 after 5:30 p.m.

1976 Volvo 242, 4 spd., AC, AM/FM stereo, \$2,800. Call 333-0813 or 996-9715 evenings.

1980 Subaru hatchback, white/gray interior, \$2,000; 1981 150 Ford PU, two tone tan, \$5,700. Call Paula Myers, x3116 or 338-2457.

1979 El Camino, excellent condition, one owner, see to appreciate. Call 332-0047.

1979 Plymouth Champ, AM/FM stereo, sunroof, Stewart and Warner gauges, \$1,995. Call Jeff, x3967 or 996-0755 after 5 p.m.

1965 Mustang convertible, six cyl., three spd., AC, red w/white top, excellent condition, \$5,500. Call 996-7559 after 5 p.m.

1979 Monte Carlo Landau, PS, PB, AM/FM cassette stereo, power window, locks, good condition, \$2,900 OBO. Call Sandra Sims, x4748 or 332-7907 after 5 p.m.

1973 Toyota Corona station wagon, needs engine (18 RC), whole or parts,

make offer; 1977 Chevy Vega hatchback, needs engine, \$145. Call Max Kilbourn, x4091 or 482-7879.

1983 Chrysler New Yorker, tan/brown, loaded, excellent condition, must sell, blue book wholesale. Call Dianna, x2868 or 474-5759.

1965 Chevy Malibu, rebuilt 350 engine, new tires, needs minor repairs, \$1,000. Call 331-1337 after 5 p.m.

1977 Pontiac Phoenix, air, auto, power steering, tilt wheel, new tires, \$1,700. Call 485-3628.

Boats & Planes

Hobie Mono-Cat sailboat, 12 ft., new rigging and trailer, ready to sail, \$700. Call Keith, x5381 or 334-6718.

Aquarius sailboat, 21 ft., trailer, head, galley, depth finder, swing keel, 6 h.p. evinrude, \$4,200 OBO. Call Kennedy, x2569 or 644-7344 after 6 p.m.

Hobie Cat sailboat, 14 ft., trailer, excellent condition, \$1,300 OBO. Call 526-9116 after 5 p.m.

Sol Cat 18 ft. catamaran, new trampoline, galvanized trailer w/two beach tires, \$1,650. Call Bill Sherburne, x3262 or 668-6965.

19 ft. MFG center console and sportsman trailer, great for fishing, pleasure, good condition, \$2,500. Call Marilyn Blevins, x6571 or 538-2172 after 5 p.m.

Piper Lance aircraft, 6-place club seating, \$85/hr. wet. Call Damewood, 482-5572.

1976 30 ft. Clipper marine fiberglass sailboat, 15 h.p. inboard engine, new mast, radio and depth finder, marine head, \$12,900. Call 554-2476.

1980 Chris Craft 17 ft. runabout, 200 h.p., Chevy V8 engine, custom tandem, shoreline trailer, beautiful, \$8,900. Call 554-2476.

1971 Fabugas 125 Johnson outboard motor, needs work. Call 485-1931 after 6 p.m.

18 ft. Larson tri-hull/walk-thru windshield, 125 h.p. Johnson o/b, galvanized tilt trailer, Buddy bearing, storage-kept, \$3,250. Call Larry, x4804 or 481-9058.

Cycles

1975 Honda 750F Supersport, MC, low mileage, excellent condition. Call Bullock, 326-4949.

20 inch Super Mongoose bicycle, all chrome, like new, was \$320, asking \$195. Call McNeely, x6347 or 482-5837.

24 inch Sears Spirit boys 10 speed, good condition, \$40. Call 474-3507.

1973 Honda CB350, excellent condition, faring, luggage rack, always garaged, 16K miles, \$300. Call Dean, x5381 or 488-7032.

Four dirt and street motorcycles, 100, 125, 450cc, \$50 each. Call Robert L. Robinson, x3697.

1975 Honda 750F Supersport, MC, low mileage, excellent condition. Call 326-4949.

Girls 24 inch 3-speed Ross bike, racing handle bars, hand brakes, good condition, \$40. Call 333-3601 after 6 p.m.

1981 Kawasaki CSR305, excellent condition, 4,000 miles, \$600. Call 488-3819 evenings.

Mens 27 inch 10-speed, new, \$75. Call 333-0813 or 996-9715 evenings.

Girls 10-speed AMF bike, \$45. Call Paul, 333-3071.

1971 Honda CB450, 2,400 actual miles, wixom faring, crash bars, carrier, mint condition, \$1,100. Call 486-9335.

1978 Honda Hawk, 14K miles, recently rebuilt engine, runs fine. Call Hendrickson, x4053 or 470-2293.

1981 Yamaha Yzinger 50, small kids dirt bike, shaft drive, ec, \$325. Call Chuck, x5101 or 480-8452.

Audiovisual & Computers

Hayes micromodem IIe (internal) w/Smartcom I, 3 mos. old, \$190. Call Jeff, x4021 or 488-2405 after 6 p.m.

DEC personal computer, VT180, dual floppies, LA-50 printer, CPM, basic, multiplan, word processor, \$1,800. Call Dan Danley, 280-7413.

Commodore 64 computer, 1541 single disk drive, 1702 color monitor, Brother HR-15 Daisy-Wheel printer, spreadsheet software, database software, word processor software, games, more. Call Gail, x7445.

Macintosh computer, external disk drive, Imagewriter printer, MacWrite, MacPaint software, computer desk/chair, printer stand, manuals, \$2,500. Call Gary, x4208.

Heathkit GR295, 25 inch color TV, \$200. Call 488-4089 after 5 p.m.

VIC 20, \$30; 13" Zenith B/W TV, \$20; Olympic AM/FM 8 track stereo plus 20 tapes, \$25; Emerson digital AM/FM clock radio, \$15. Call Pete, x5021 or 326-5464.

TRS-80 model 4 computer with two disk drives, traction feed printer and stand, 35 blank disks, RS232 modem, disk holders, Super Scriptist and training tapes, some software. Call Ray, x6237 or 554-5434.

Wanted

Fiberglass bass boat with 50-150 h.p. motor, galv. trailer, aerated live well. Call Don, 280-6307 or 554-6205.

Carpool member for non-smoking carpool, Friendswood to Bldg. 45. Call Jay, x3126; Richard, x4606 or Jay 482-3843 after 5:30.

Roommate to share house in League City, \$230/mo. plus 1/3 bills. Call Galen, x3576 or 332-8837.

U.S. Army Airforce A-2 jacket (WWII). Call Tami, 333-4980.

Housemate to share 5-4-2 in Friendswood, fully furnished, W/D, cable TV, microwave, hot tub, \$225/mo. excluding utilities. Call Rowena, x4621 or 996-9249.

16mm projector. Call James Weldon, x4971 or 482-1461.

Ride for work from Pasadena to NASA, hours 7:7:30 a.m. to 3:30/4 p.m. Call Mary Cunningham, x3580 or 475-1992 after 4:30.

Roommate to share 3-2-2 near NASA, non-smoker preferred, W/D, cable TV, \$250/mo. plus 1/2 bills, deposit required. Call David, x6571 or 480-6395 after 4 p.m.

Riders for vanpool, Meyerland Plaza to NASA area. Call Richard Heetderks, x4651 for more information.

One refrigerator and W/D for new home. Call Tami, 532-2642.

Electric trains, electric typewriter. Call Don Jeffers, x2449.

Back issues of Astrophysics Journal. Call Fred Becker, x3829.

Household

Chair-bed, opens into twin-size bed, good cond., \$50; Pedestal chair, contemporary, fiberglass, \$25; Rocker-recliner, vinyl, \$35. Call 486-8266.

Dining room set, table, four chairs, Spanish style, like new, \$85. Call Joan x3057 or 486-1058 after 5 p.m.

Canopy bed, twin size, springs, mattress, white canopy, \$65. Call Keyes, 333-2132.

Sofa and loveseat, brown/rust with wood framing, excellent condition. Call Sheryl, x2881 or 333-9408 after 5 p.m.

Walnut TV stand, 5 ft. tall, includes roll-out turntable base, lower cabinet for records, like new, \$75. Call 488-3819 evenings.

Modern walnut bedroom set, dresser, mirror, chest, night stand, bed, excellent condition, \$300. Call Joe, 280-7827 or 946-8825 after 5 p.m.

Twin bed, mattress, box springs, headboard, frame, \$55 or two sets for \$100. Call Jeff, x4237.

Matching couch, love seat, ottoman,

brown w/light trim, excellent cond., \$300 OBO. Call Jeff or Kathy, 488-2405 after 6 p.m.

Living room chair, gold cloth, high back, fixed reclined position, \$20. Call 480-1942 or 280-7090.

Miscellaneous

Playpen, \$10; high chair, \$15; changer, \$25; all in good condition. Call Tim, x5169 or 280-9774.

Kidder XK/1 Kevlar slalom ski w/case, Connelly front plate binding, rear adjustable boot, excellent ski, condition, price, \$150. Call 474-5258 after 4 p.m.

Johnson/Evenrude SST propeller, excellent condition, \$110. Call Eddie, 473-2709.

21 inch Toro lawnmower, electric start, self-propelled, good shape, \$100. Call Jay, 473-2709.

25 ft. box shrimp net with 2' x 4' boards, steel runners, excellent condition, \$350. Call Harvey Myers, x5381 or 488-7032.

Bierhaus home brewing kit, \$20; pool table light, \$40; lighted beer sign-National, \$15; beer can collection-72 cans, \$50; boys bike, \$10; 28 x 70 inch wooden work bench, \$25. Call Pete, x5021 or 326-5464.

Signet oboe, excellent condition, \$450. Call Amy, x2651 or 486-6738 evenings.

Patio table, 42" round, opaque glass top. Call Charlie, 486-6789 or 488-3346.

Prom dress, size 5, sheer nylon over tafetta, three ruffles and flounce, worn once and not in Clear Lake-Creek area, half-price at \$80. Call Barbara, 337-3683.

22 LR Survival rifle-Charter arms AR-7 Explorer, breaks down to waterproof 16" stock, one year old, \$70. Call Jay, x3696.

Front door for residence, 36 x 80 inch, best offer. Call Briggs, x5165 or 333-2717.

Two Sears radial tires, BR 78-13, fits Pinto, Mustang, some Chevy and Mazda, used but many miles left, \$10 each. Call Greg, 480-1942 or 280-7090.

Black mare, 11 yrs. old, not registered, \$600; black filly, 9 mos. old, not registered, \$300; Western saddle, new, \$300; purchase all the above and receive free: bridle, halters, lead ropes, saddle blankets, old saddle, more. Call Paula Myers, x3116 or 338-2457.

Chainlink dog run, 4x4x10, \$75 OBO. Call Frank, x2417 or 486-0413.

Hummingbird Fish Flasher, \$90; electric winch, \$100; two drawer file, \$25. Call Jack Day, x4731 or 664-9472.

Kimball Swinger 700 organ, like new, \$500 OBO. Call 481-4612 after 5 p.m.

Girls pink bike, \$30; all wood coffee table, \$50; two bar stools, \$40 each; Spanish lamps, \$20 each; bowling ball and bag, \$20. Call Dianne, x2558.

14" wheel covers from 1982 Dodge 400 K-car. Call Bob, x3445 or 921-1715 after 6 p.m.

13 x 5.5 inch mag wheels for Datsun or Toyota, two sets; Shelby Viper, new, \$140; Minilite (used with Semperril radials), \$180. Call Bill Sherburne, x3262 or 688-6965.

Gilruth Center News

Call x3594 for more information

Defensive driving — Learn to drive safely and qualify for a 10% reduction in your insurance for the next three years. Class will be held from 8 a.m. to 5 p.m. on May 18. The cost is \$20 per person.

Intermediate advanced shorthand — This course will teach the basic skills of reading and writing Gregg shorthand. Class work includes speed building. Bring a shorthand notebook and pen to class. This six week course will be held from 5:30 to 8 p.m., starting June 12. The cost is \$85 per person.

Exercise class — Come stretch with the gang in this co-ed class. The course will meet from 5:30 to 6:15 p.m., Monday through Friday. The cost is \$20 per person.

Word processing — Learn about wordstar and how to apply it to IBM, Apple and other computers. Emphasis will be on legal letters, resumes, etc. This six week course will meet from 5:30 to 8 p.m. starting on June 12. The cost is \$190 per person.